Dynamical Simulation of DCC Formation in Bjorken Rods*

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Using a semi-classical treatment of the linear σ model, we simulate the dynamical evolution of an initially hot cylindrical rod endowed with a longitudinal Bjorken scaling expansion (a "Bjorken rod"). The field equation is propagated until full decoupling has occurred and the asymptotic many-body state of free pions is then obtained by a suitable Fourier decomposition of the field and a subsequent stochastic determination of the number of quanta in each elementary mode. The resulting transverse pion spectrum exhibits visible enhancements below 200 MeV due to the parametric amplification caused by the oscillatory relaxation of the chiral order parameter. Ensembles of such final states are subjected to various event-by-event analyses. The factorial moments of the multiplicity distribution suggest that the soft pions are non-statistical. Furthermore, their emission patterns exhibit azimuthal correlations that have a bearing on the domain size in the source. Finally, the distribution of the neutral pion fraction shows a significant broadening for the soft pions which grows steadily as the number of azimuthal segments is increased. All of these features are indicative of disoriented chiral condensates and it may be interesting to apply similar analyses to actual data from high-energy nuclear collision experiments.

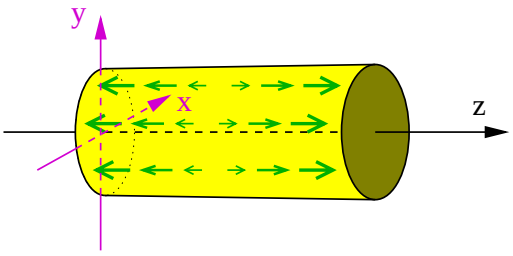

Figure 1: The initial configuration of the chiral field describes a rod-like system subject to a longitudinal scaling expansion of the Bjorken type, for which the local boost rapidity is given by $\mathsf{y} = z/\tau$.

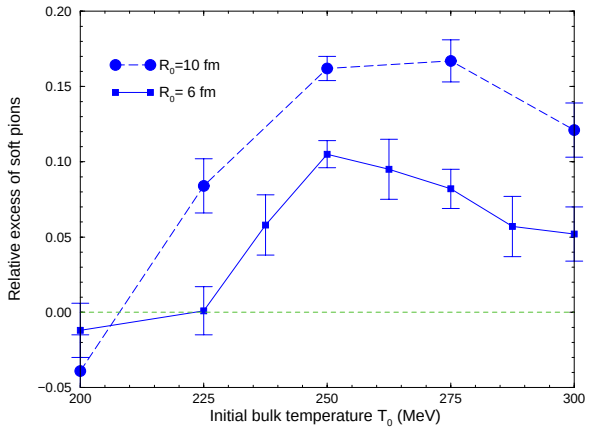

Figure 2: The relative excess of pions for Bjorken rods with initial radii R_0 equal to either 6 or 10 fm, as a function of the initial bulk temperature T_0. The excess has been obtained by subtracting the yield of pions with kinetic energies below 200 MeV from the corresponding equilibrium spectrum obtained by fitting the dynamical result with a Bose-Einstein form within 200-1000 MeV.

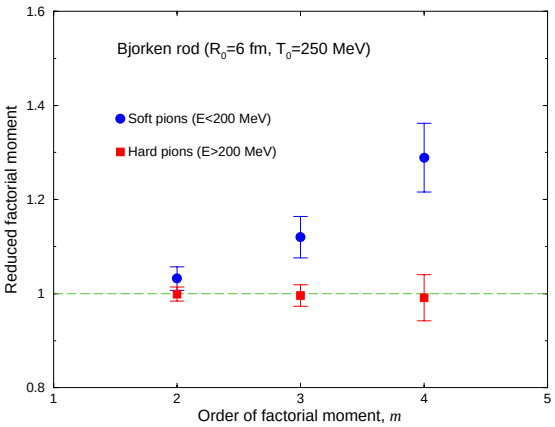

Figure 3: Reduced factorial moments of the pion multiplicity $\langle N(N-1)\cdots(N-m+1)\rangle/\langle N\rangle^m$ obtained for a sample of rods prepared with $R_0 = 6$ fm and $T_0 = 250$ MeV displayed as a function of the order m, for either soft (dots) or hard (squares) pions.

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